STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

August 29, 2007

Mr. Greg Cochran, Director
Michigan Dioxin Initiative
Michigan Operations
The Dow Chemical Company
1790 Building
Washington Street
Midland, Michigan 48674

Dear Mr. Cochran:

SUBJECT: Notice of Deficiency (NOD); Remedial Investigation Scope of Work for the Saginaw River and Floodplain and Saginaw Bay, Michigan; The Dow Chemical Company, Michigan Operations (Dow); MID 000 724 724

The Michigan Department of Environmental Quality (MDEQ) has reviewed the Remedial Investigation Scope of Work for the Saginaw River and Floodplain and Saginaw Bay, Michigan (SOW), submitted by Dow to the MDEQ for review and approval on July 13, 2007, in advance of the August 12, 2007, deadline identified in Dow's Hazardous Waste Management Facility Operating License (License). The MDEQ review resulted in the identification of certain general and specific deficiencies, which are presented in the enclosed NOD.

In accordance with Condition XI.B.4. of your License, Dow is required to modify the SOW in accordance with, or based on the resolution of, the identified deficiencies and to resubmit a new or revised SOW within 30 days of receipt of this NOD.

The MDEQ has also requested comments from the Natural Resource Damage Assessment Trustees (Trustees), who anticipate providing comments soon. The MDEQ remains committed to coordinating, to the extent practicable, the corrective action investigation and remediation of the Saginaw River and Floodplain and Saginaw Bay with the investigation and restoration efforts of the Trustees. Upon receipt, Dow should consider and, to the degree possible, incorporate the Trustees' comments into revisions to the SOW.

It was noted during the review of the SOW that Dow is proposing to conduct several components of the proposed investigation yet this field season. However, the Dow-proposed schedule does not contemplate or provide any time for MDEQ review or approval of the work plan associated with these activities. To the extent practicable, and dependent upon Dow's ability to provide approvable work plans in advance of the proposed work, the MDEQ is willing to grant partial approvals of remedial investigation work that both Dow and the MDEQ agree is necessary and prudent to conduct yet this field season.

Should you have questions regarding this NOD, please contact Mr. Allan Taylor, Hazardous Waste Section, Waste and Hazardous Materials Division, at 517-335-4799 or by e-mail at taylorab@michigan.gov, or you may contact me.

Sincerely,

George W. Bruchmann, Chief
Waste and Hazardous Materials Division
517-373-9523

Enclosure
cc/enc: Mr. Ben Baker, Dow
Mr. Peter Wright, Dow
Mr. Jack Bails, Public Sector Consultants
Ms. Margaret Guerriero, U.S. Environmental Protection Agency, Region 5
Mr. Gerald Phillips, U.S. Environmental Protection Agency, Region 5
Mr. Greg Rudloff, U.S. Environmental Protection Agency, Region 5
Mr. John Steketee, U.S. Environmental Protection Agency, Region 5
Dr. Lisa Williams, U.S. Fish and Wildlife Service
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Ms. Judith Gapp, MDEQ
Ms. Cheryl Howe, MDEQ
Dr. Deborah MacKenzie-Taylor, MDEQ
Mr. Arthur Ostaszewski, MDEQ
Mr. Allan Taylor, MDEQ

NOTICE OF DEFICIENCY

The Dow Chemical Company
Midland, Michigan
MID 000 724 724

Remedial Investigation Scope of Work
for the Saginaw River and Floodplain and Saginaw Bay, Michigan

August 29, 2007

General Deficiencies

1. **Current Conditions Report**
The Scope of Work (SOW) must be revised to indicate that the Current Conditions Report will be submitted in advance of, or with, the Phase I Work Plan.

The Dow Chemical Company (Dow) is proposing a limited or "focused" Remedial Investigation Work Plan (RIWP) that is based, in part, on the availability of historic investigation data on the Saginaw River and Saginaw Bay. If Dow chooses to propose a limited RIWP that is based on previously collected data, then Dow must provide a comprehensive Current Conditions Report that (1) summarizes the existing and relevant data and (2) shows how such data meet or partially satisfy the requirements of the RIWP. The Current Conditions Report must be submitted sufficiently early in the remedial investigation process in order for the Michigan Department of Environmental Quality (MDEQ) and Natural Resource Damage Assessment Trustees (Trustees) to determine the adequacy of the proposed work plans to fill the data gaps identified by the Current Conditions Report.

2. **Adequate Time for MDEQ Review and Approval**
The SOW must be revised to provide adequate time for MDEQ review and approval. The SOW provides a general overview of the activities and time lines proposed. Work Plans are to follow for the specific studies, yet as it is currently proposed, the SOW provides absolutely no time for the MDEQ, the U.S. Environmental Protection Agency (U.S. EPA), or the Trustees to review and comment prior to MDEQ approval of the Work Plans. For example, the schedule (Table 4-1) has September 1, 2007, as the submittal date for the Phase I Work Plan AND the start date of work activities for Phase I (2007) Work Activities.

Dow must provide at least 45 days to the MDEQ, the U.S. EPA, and the Trustees to review Work Plans, and no work should commence without Agency approval of the Work Plan or components of the work plans that have not been specifically approved by the MDEQ.

3. **Use of Alternate Dispute Resolution (ADR) Workgroup in Lieu of Formal Regulatory Approval is Unacceptable**
As previously communicated to Dow, the concept of using the ADR workgroup to approve the work required under Dow's Hazardous Waste Management Facility Operating License (License) is not acceptable. The License does not allow the MDEQ to delegate its regulatory authority to another entity. The SOW must be revised to be consistent with the structure and intent of the License. An ADR

technical workgroup may be used to help guide and develop work plans prior to their submittal to the agencies, but upon submittal, the work plans will be treated as public documents by the MDEQ and agency approval will be required prior to implementation. The License specifically requires review and approval of the RIWP by the Chief of the Waste and Hazardous Materials Division.

4. **Interim Response Activity/Presumptive Remedy**

Adequate information exists to support the concept of maintenance dredging of the navigational channel of the Saginaw River as an Interim Response Activity (IRA)/ Presumptive Remedy to reduce the loading of dioxins and furans to the Saginaw Bay. It is noted that the SOW mentions "Consideration of expansion of current sediment trap pilot program" (Table 1-1, XI.B.3[a]). These actions need to be significantly accelerated in the Saginaw River to limit further contamination of Saginaw Bay with dioxins and furans and other potential constituents of interest (PCOIs) related to Dow.

The SOW must be revised to identify a process and time line beginning in fall 2007 that provides for the systematic maintenance dredging of the navigational channel of the Saginaw River and evaluation of expansion of sediment traps beyond the navigational channel. Dow, working with the MDEQ and the U.S. Army Corps of Engineers, must be prepared to provide for the dredge contracting of Saginaw River navigational areas (turning basins and channel, where appropriate), beginning in fall 2007.

5. **Compliance with R 299.5528**

The SOW must be revised to provide a better description of the overall remedial investigation/corrective action strategy being proposed by Dow. Pursuant to R 299.5528(2) of the administrative rules promulgated pursuant to Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 201 Rules), the MDEQ shall approve RIWPs or reports for work done in phases if all of the following conditions are satisfied:

(a) Anticipated subsequent phases of investigation are described in sufficient detail so that the MDEQ can determine that the phase being proposed or reported on is appropriately defined.

(b) The RI described in the work plan (WP) or report complies with the requirements of this rule for the scope it is intended to address.

(c) If conducting the RI in phases will not prevent the RI from being completed in a timely fashion.

With respect to R 299.5528(2)(a), the SOW must be revised to clearly identify the remedial alternatives that are under consideration by Dow and describe how the limited or "focused" investigation approach proposed in the SOW will support the evaluation of potential remedial alternatives and/or the implementation of presumptive remedies. Sufficient clarity must be provided to show that the proposed work and/or the proposed phasing of work are adequate and appropriate in the context of the overall corrective action process. The data collected must be

sufficient to provide the information necessary to evaluate remedial alternatives and to provide for the assessment of natural resource damages.

Rather than focusing on natural recovery processes/natural attenuation (reference comment 9, below), the SOW must be revised to identify the range of potential remedial alternatives and to describe how the proposed phasing of data collection under the proposed work plans will develop the information to support remedial decision-making and/or implement presumptive remedies.

With respect to R 299.5528(2)(b), the SOW must be revised to clearly identify how the proposed investigations will comply with the applicable requirements of R 299.5528(3). The MDEQ has determined that all of the requirements of R 299.5528(3) are potentially applicable to this very large scale RI. An acceptable method of addressing this requirement would be to provide tables that identify where and how the requirements of R 299.5528(3) will be addressed by the implementation of the work plans proposed in the SOWs.

6. **Conceptual Site Model**

The SOW does not provide a Conceptual Site Model or list the specific exposure pathways that are currently known to be present or identify other exposure pathways that may be present and require investigation. The SOW must be modified to describe the known and suspected human health and ecological exposure pathways.

As currently constructed, the SOW does not specifically identify exposure pathways or propose key exposure pathway investigation work to support the human health risk assessment (HHRA) or ecological risk assessment (ERA). The SOW must be revised to identify all of the known and suspected exposure pathways and to identify a process in the proposed work plans that provides for the collection of information necessary to evaluate these pathways during the implementation of the work plans. This information is necessary to develop cleanup criteria.

It should be noted that much of this work was completed for the Tittabawassee River and summarized in tables developed collaboratively by Dow and the MDEQ by the Exposure Pathway Workgroup. These tables identified the known relevant exposure pathways for the Tittabawassee River and identified data must be addressed in the initial phases of the remedial investigation. These tables could readily be modified to reflect Saginaw River and Saginaw Bay conditions and submitted as part of the SOW to address this deficiency.

7. **Interim Response Activities**

The SOW does not adequately anticipate or address interim response activities (IRAs) in the Saginaw River and Saginaw Bay. While the SOW mentions that data collected will be used to identify potential IRA action, the SOW must also identify a process to identify and implement IRA triggers, actions (e.g., hot spot characterization, mobilization, and disposal), and associated time lines. The SOW must be revised to include proposed IRA thresholds (triggers) and subsequent actions for Saginaw sediments and floodplain soils, similar to the processes,

triggers, and time lines laid out for the implementation of IRAs for the Tittabawassee River.

8. **Direct Investigation of High Concern Properties**
The SOW must identify a process that provides for the direct investigation of residential and agricultural properties that are of highest concern – those that have been flooded repeatedly in the last 100 years.

The MDEQ is not opposed to the concept of developing an adequate geospatial model, as suggested by the SOW to predict levels of contamination in appropriate portions of the floodplain (i.e., areas where an adequate presumptive remedy is proposed or where there is less concern for human exposure). However, in the absence of a proposal for a presumptive remedy(ies) for these areas, it is not appropriate to use a model to predict concentrations on properties where there is the highest level of concern. In these areas, representative soil concentration data, rather than modeled results, is necessary to ensure adequate protection of human health.

This type of sampling will also partially satisfy the SOW requirement to collect information to support the HHRA by providing a population of sample concentrations from the areas of highest human exposure concern that adequately represents the "exposure units" (i.e., the property size for a variety of land use) with the highest contamination levels. This would represent a reasonable high-end exposure scenario for use in the HHRA.

9. **Focus on Monitored Natural Recovery**
It was noted that the SOW currently appears to focus specifically on "natural recovery processes via burial or natural attenuation" as a remedial alternative. Current contaminant data does not indicate that natural attenuation/burial, on its own, is successful as a long-term remedial process for dioxins/furans and other PCOIs in the Saginaw River and Saginaw Bay. In order to evaluate the effectiveness of monitored natural recovery in conjunction with other remedial alternatives, the SOW must be revised to include a process that evaluates and reasonably predicts the rate of decrease of dioxins, furans, and other PCOIs in Saginaw River and Saginaw Bay media (sediment, soil, fish, wild game, etc.). This evaluation will need to be done using a matrix of remedial responses, including source control, monitored natural recovery, dredging, source control, and capping.

Additionally, the SOW does not acknowledge other natural and anthropogenic processes such as flooding and shipping traffic that result in the mobilization and redistribution of contaminated sediment. The SOW must be revised to objectively evaluate both the benefits and risks of natural recovery in riverine and lake systems. This includes evaluation of the amount of time necessary for natural recovery to become effective as a remedial alternative.

10. **Include Mass Balance/Loadings as an Assessment of the SOW**
The SOW phased activities do not reflect recent data (CH2M Hill, MDEQ, ENVIRON) that strongly imply an active source of dioxin and furan loading to the Saginaw River

and Saginaw Bay from the Tittabawassee River. The SOW must be revised to include a strong emphasis on the mass balance and movement of contaminant mass through the upper, middle, and lower compartments of the Saginaw River into the Saginaw Bay. This will provide an understanding of how much mass is entering each Saginaw River/Bay compartment (see comment 21, bullet 5), how much is exiting, how much is being stored in each compartment, and what factors are influencing the transport or retention of contaminants in and between compartments. The MDEQ acknowledges that there are activities proposed in the current SOW (hydrologic studies, sediment transport studies, and river morphological studies) that suggest a mass balance based approach.

11. **Development of Time Lines for Recovery Based on Multiple Response Actions**
The SOW identifies assessment of contaminant exposure and risk with regard to the "natural recovery processes via burial or natural attenuation" as one scenario. Existing site-specific data do not indicate that natural attenuation/burial is a significant process in the Saginaw River for the time frame necessary to adequately protect human health and the environment as required under Part 201.

The SOW should incorporate the objective of projecting time lines of dioxin/furan and other PCOI decreases in sediments, biota, and related ecological and human health risk reduction for the Saginaw River and Saginaw Bay, using a matrix of remedial responses, of which monitored natural attenuation is one scenario. Other remedial responses to consider include source control, capping, dredging, etc.

12. **Other Concepts**
The SOW must be revised to explain how the following concepts will be addressed in the development of the work plans:

- How the location and depth of historical sediment and floodplain deposits will be determined (i.e., geophysics followed by coring and chemical analysis)
- The depth at which the navigation channel needs to be maintained to prevent remobilization of sediments
- How the bedload and suspended solids contamination load will be determined
- The list of references that will be used to compile the "Current Conditions Report"

Specific Deficiencies

13. **Title Page**
Dow submitted "The Conceptual *GeoMorph*™ Scoping Study, Upper Saginaw River, Saginaw, Michigan" prepared by Ann Arbor Technical Services (ATS) to the MDEQ in April 2006. The MDEQ and Dow agreed to defer implementation of the Upper Saginaw River Scoping Study until the *GeoMorph*™ Pilot for the Upper Tittabawassee River was complete and approved.

The SOW must be revised to clarify the status of the ATS USR Scoping Study document (i.e., whether the ATS Scoping Study is superseded by the ENVIRON SOW and associated proposed RIWP).

Pursuant to Condition XI.B.6. of the License, the title for the SOW must be revised to reflect that, in addition to the Saginaw River and Saginaw Bay, the SOW also addresses the Saginaw River Floodplain.

14. **Section 1.1, Purpose and Overview**
As noted above in comment 5 (Compliance with R 299.5528), the SOW must be revised to show how the requirements of the R 299.5528(3) are being met or will be met by the implementation of the proposed work. This section should also be clarified to indicate that the RIWP work will be conducted to support the natural resource damage assessment (NRDA) work that is being conducted concurrently with the corrective action investigation.

15. **Section 1.2.1, Objectives**
The following additional questions, at a minimum, must be included in the list of questions to be answered by data generated from work activities:

- What is the distribution of the contaminants or PCOIs related to Dow in the Saginaw River and Saginaw Bay?
- What human health and ecological exposure pathways are present and significant for PCOIs released from Dow in and along the Saginaw River and Saginaw Bay?
- What information needs to be developed to support the development of cleanup criteria for floodplain soils and sediments in and along Saginaw River and Saginaw Bay?
- What are the nature, extent, and environmental fate of PCOIs that were released from Dow and are present in media in and along the Saginaw River and Saginaw Bay?
- What is the mass of contamination related to historic Dow releases that is moving into the Saginaw River from the Tittabawassee River? What is the mass of contamination related to historic Dow releases that is moving from the Saginaw River into the Saginaw Bay?
- What is the effect of river barge and freighter traffic on contaminants in the navigational channel of the Saginaw River and Saginaw Bay?
- What additional IRAs are necessary to limit human exposure to PCOIs?
- What IRAs are necessary to limit or minimize the spread of contamination into the Saginaw Bay?

16. **Section 1.2.1, Objectives, and Section 1.2.2, Implementation of the Work**
These sections must be revised to contain a specific objective relating to data management. Data review and management must be transparent. Data must be available to regulatory agencies and the general public pursuant to the requirements of Dow's License in formats useful to the MDEQ, the U.S. EPA, and the Trustees. As previously discussed with Dow, portable document format submittal of data results is not sufficient if rapid review and approval is necessary. Use of the ADRM/NRDA database is encouraged and should be an identified step in the management of the data collected and/or utilized during the implementation of the RIWP.

17. **Section 1.2.2.b., Implementation of the Work - Saginaw River / Bay Current Conditions**
This section must be clarified to indicate that the Current Conditions Report will be submitted for MDEQ review and approval prior to or with the Phase 1 Work Plan.

18. **Section 1.2.2.d., Implementation of the Work - Implementation of Field Investigation Activities**
The following revisions/clarifications are required in this section:

- Sampling proposed for the Saginaw Bay appears to be limited to selected beachfronts and drinking water supply. Dow's License does not limit the scope of investigation as proposed in the SOW. The SOW must be revised to indicate that data collection in the Saginaw Bay will be comprehensive enough to make remedial decisions, support the NRDA, and ensure protection of human health and the environment. It is likely that substantial additional investigation of the Saginaw Bay will be required as part of the Remedial Investigation process. The extent of additional investigation will be determined by the review of existing data (Current Conditions Report) and the identification of data gaps, the needs of the Trustees, and the level of information necessary to make remedial decisions. For example, if it is determined that monitored natural recovery is appropriate for the Saginaw Bay, it will be necessary to identify baseline conditions in Saginaw Bay sediments and fish to monitor recovery and to determine and scope natural resource damages.

- This section indicates that "Work will focus on the Saginaw River (beginning at the confluence with the Tittabawassee and Shiawassee Rivers and extending to the Saginaw Bay) and Saginaw Bay." However, there is no map that shows how far out into the Saginaw Bay the characterization will extend. The SOW must be revised to provide a map of the study area, which at this time must include any part of the Saginaw Bay that contains contamination related to Dow in concentrations that exceed applicable criteria (e.g., sediment contamination, fish contamination, etc.).

- A number of field activities are proposed for initiation in September 2007. In order to receive MDEQ review and approval for these field activities, Dow will need to immediately submit detailed work plans for the proposed work. See also the comments on geospatial analysis in comments 8 and 35.

- As previously communicated to Dow, baseline sampling of key fish species from the Saginaw Bay is necessary for HHRA and public health evaluation purposes. This work should be scheduled for completion this year along with the sampling of selected beachfronts and water supplies.

- The Phase 1 work must be revised to anticipate and monitor a flood event in spring 2008, capturing data related to flow, sediment resuspension, and contaminant transport during this event through predetermined reaches of the Saginaw River and out into the Saginaw Bay.

19. **Section 1.2.2.e., Preparation of Work Summary Reports**
This section must be revised to indicate that the Current Conditions Report will be provided as a deliverable in advance of, or concurrent with, the Phase 1 Work Plan.

Monthly meetings related to the Saginaw River/Bay work plans should be anticipated and scheduled, similar to what was done with Public Sector Consultants and the ADR Sediment Trap Technical Work Group.

20. **Section 2, Scope of Work**
This section must be clarified to indicate that the "primary purpose of the work summarized in this SOW is to characterize the *extent of contamination* [emphasis added] and the fate and transport of substances originating from the Dow Midland Plant" and other work, as necessary, to address the requirements of Dow's License and the associated regulatory requirements.

This section refers to a "current sediment management strategy for the entire Saginaw River and Saginaw Bay." The SOW must be revised to describe the sediment management strategy that this statement refers to and identify the source of this strategy.

21. **Section 2.1, Definition of Study Area**
This section of the SOW must be revised as follows:

- The SOW states, in part, that "In Saginaw Bay, the study area begins at the confluence with the Saginaw River and extends into areas of the bay where MDEQ has identified areas of potential concern (e.g., water intakes and certain beaches along the bay)." While the MDEQ has identified these as areas of potential concern, the MDEQ has not limited the extent of Dow's corrective action obligations with respect to the Saginaw Bay as implied by the SOW. The SOW must be revised to indicate that the area of investigation at this time includes all areas of the Saginaw Bay where contamination attributable to Dow has come to reside at concentrations of concern. At this time, this includes both Inner and Outer Saginaw Bay. It is anticipated that the Current Conditions Report will assist with refining the area of investigation in the Saginaw Bay.

- It is not appropriate at this point to limit the SOW activities as identified in paragraph 3 of Section 2.1. Dow has not yet completed or submitted the Current Conditions Report to identify the data gaps that will need to be filled by additional investigation. The SOW must be revised to reflect this correction in the definition

of the Saginaw Bay study area. The SOW must also be revised to reflect the fact that additional work, beyond that proposed in Section 2.1 and otherwise identified in this Notice of Deficiency, will likely be necessary.

- Section 2.1 must be revised to include the collection and analysis of key fish species from Saginaw Bay for Dow-related PCOIs.

- Section 2.1 must be revised to include defining the extent of contamination from Dow-related PCOIs in the Saginaw River and Saginaw Bay sediments and floodplain.

- The SOW states: "The Saginaw River is divided into the following three reaches. The Upper Saginaw River (USR) extends from the confluence with the Tittabawassee River to (but not including) the Sixth Street Turning Basin, a distance of approximately five river miles. The Lower Saginaw River in Saginaw County (LSR-SC) extends from the Sixth Street Turning Basin to the Saginaw County-Bay County boundary, a distance of approximately six river miles. The Lower Saginaw River in Bay County or LSR-BC extends from the Saginaw County-Bay County boundary to the mouth of the river at Saginaw Bay, a distance of approximately 11 river miles."

  Because of the major disturbances at active turning basins and the potential function of inactive turning basins as sediment traps, the MDEQ would prefer that reaches in the Saginaw River be compartmentalized by location of the turning basins as follows, for example:

  USR – Upper Saginaw River: Confluence to (including) Sixth Street Turning Basin (SSTB)
  MSR – Middle Saginaw River: SSTB to (including) Airport Turning Basin
  LSR – Lower Saginaw River: Airport Turning Basin to Mouth (River Mile Zero)
  SAGB-I – Saginaw Bay Inner (East of Nav. Channel , West of Nav. Channel)
  SAGB-O – Saginaw Bay Outer (East of Nav. Channel, West of Nav. Channel)

22. **Section 2.2, Proposed Investigation Activities – Phase 1**
The SOW must be revised to include the following elements in the initial phases of work:

- The collection and analysis of key fish species from Saginaw Bay Dow-related PCOIs.

- Investigation of the effects of dredging activities and ship traffic on mobilizing contaminated sediment.

- Sampling and analysis of bedload and suspended load samples from the Saginaw River and Saginaw Bay at selected points in the Saginaw River and Saginaw Bay.

- Sampling and analysis of soils and sediments for Dow-related PCOIs in areas of high concern. This includes sampling of residential areas and agricultural areas that have experienced repeated flooding in the last 100 years.

- Development of necessary data to support the HHRA and ERA.

- Identification and implementation of any necessary IRAs for implementation beginning in 2008.

- Identification and implementation of any presumptive remedies to control human exposure and limit spread of existing contamination (e.g., sediment traps, navigational dredging, etc.).

23. **Section 2.2, Proposed Investigation Activities – Phase 2**
The SOW must be revised to include the following elements in the second phase of work:

- Conduct sampling and analysis to fill data gaps identified during review of the Current Conditions Report and to complete nature and extent component of the remedial investigation.

- Develop a plan and conduct baseline sampling of the Saginaw Bay for monitored natural recovery component of remedial action.

- Continued identification and implementation of any necessary IRAs for implementation in 2008.

- Continued identification and implementation of any presumptive remedies to control human exposure and limit spread of existing contamination (e.g., sediment traps, navigational dredging, etc.). Dow's License requires Dow to identify exposure pathways for HHRA in the SOW (see comment above).

24. **Section 2.2, Proposed Investigation Activities – Phase 3**
The SOW must be revised to include the following elements in the third phase of work:

- A comprehensive HHRA, beyond that currently identified in the SOW. This includes all applicable pathways, including fish consumption.

- The HHRA must include identification and consideration of key receptor populations, including subsistence anglers.

- Identification of remedial alternatives for the Saginaw River and Saginaw Bay including but not limited to dredging, capping, and monitored natural recovery.

25. **Section 2.4, Hydrology**
This section must be revised to include an evaluation of the effects of barge and freighter traffic and dredging in the navigation channels of the Saginaw River and Saginaw Bay.

26. **Section 2.7, Floodplain Soils**
This section states that "Characterization of floodplain soils will be conducted only as needed…." As noted previously, Dow is required to modify the SOW to provide for the collection of floodplain soils in areas of high concern – repeatedly flooded residential and agricultural properties and high use recreation areas.

The SOW and associated work plans must also be modified to reflect the presence of elevated levels of dioxins and furans in the Saginaw River floodplain near the confluence of the Tittabawassee and Shiawassee Rivers. Previous sampling conducted by MDEQ staff has found high levels (approximately 7,000 parts per trillion TEQ) in farm fields in this area.

27. **Section 2.8, Saginaw River Sediments**
The SOW and associated work plans must be modified to include bedload/surficial sediment sampling, throughout the Saginaw River and Inner Saginaw Bay, at various times of the year as an integral part of additional assessment, primarily for mass balance determinations of effectiveness of remedial actions.

This section must be modified to indicate that sediment and floodplain sampling will be done to verify the results of any geostatistical analysis.

28. **Section 2.9, Saginaw Bay Water and Sediments**
As noted previously, it is not appropriate to limit sampling in the Saginaw Bay to beaches and water intakes as this limited sampling does not meet the intent or requirements of a remedial investigation per Dow's License and the requirements of R 299.5528(3). This section must be revised to provide for comprehensive reviews of existing data with follow-up sampling to address identified data gaps.

The Saginaw River mouth should be identified as a station location for determining the mass loading of contamination into the Saginaw Bay.

29. **Section 2.10, Environmental Chemistry**
The second paragraph of this section appears to be internally inconsistent, indicating that work activities will focus only on contaminants found in the Tittabawassee River and associated with historical releases from the Dow Midland Plant, but also indicating that it may be beneficial to understand what contaminants are present from other sources. This section should be rewritten for clarity. In certain cases, the MDEQ may require Dow to determine if a Dow-related contaminant is present in the Saginaw River and/or Saginaw Bay even if it was not detected in the Tittabawassee River (e.g., found in floodplain soils, release history or fate of chemical makes it more likely to be detected downstream, etc.).

30. **Section 2.11, Human Health and Ecologic Risk Assessment**
This section must be rewritten for clarity. Dow is required to conduct comprehensive human health and ecological risk assessments (using appropriate MDEQ and U.S. EPA guidance documents) for the Saginaw River and Saginaw Bay and to include all PCOIs associated with releases from Dow unless specifically excluded with the approval of the MDEQ. In addition, it is not clear what Dow means by the statement "some floodplain soil."

31. **Section 2.13, RIWP Process**
Note that the Tittabawassee River RIWP is under review with revisions due from Dow on September 17 and December 1, 2007. Therefore, some components cited in this section are subject to change.

32. **Section 3, Proposed Phase 1 Work Activities**
It was noted during the review of this section that there was no proposal for the sampling of biota (e.g., fish, wildlife, game, and key ecological receptors). The SOW must be revised to address this issue. This activity should be conducted in conjunction with the Trustees.

As indicated earlier, it will be necessary to review the Current Conditions Report before approving the investigation scope and process proposed by Dow.

33. **Section 3.1, Topographic, Bathymetric, and Geophysical Surveys**
This section states that "Subaqueous surveys will include bathymetry and potentially three types of geophysical surveys (including side scan sonar, sub-bottom profiling, and magnetometer surveys)."

The SOW and the associated work plan must be revised to indicate that a physical-visual method for finding the glacial/riverine uncontaminated clay in sediments will need to be implemented. Cores or borings will need to be integrated into the geophysical surveys to calibrate the geophysics and to "ground truth" the results.

This section also states that "A bathymetric survey will be conducted to develop an accurate representation of the depth and morphology of the river bottom and southwest portions of the bay." It is not clear why only the southwest portion of the Saginaw Bay would be investigated. The SOW must be revised to indicate that surveys will be conducted as necessary to develop the information necessary to identify the nature and extent of contamination in the Saginaw Bay.

34. **Section 3.4, Saginaw Bay Water and Beach Sediment Chemical Characterization**
This section states that "water samples will be collected at pumping stations located onshore that handle the flow of bay water drawn from drinking water intakes located in Saginaw Bay."

The timing of the water sampling at the intakes should coincide with high suspended sediment loads and/or wind driven turbidity peaks in the bay (most likely spring and fall). This data could be gathered from the intake facility.

With respect to sampling of beaches and water intakes, the MDEQ agrees that these are important exposure pathways that require evaluation. However, as noted earlier, it is likely that the MDEQ will require a much more comprehensive evaluation of the Saginaw Bay, beyond the limited sampling proposed in the SOW. The extent of the evaluation will be based, in part, on the Current Conditions Report.

35. **Section 3.5, Saginaw River Sediment and Soil Chemical Characterization**
This section indicates: "Spatial statistical methods have been well developed for application to environmental data (Goovaerts 1997) and have been applied in numerous studies of sediment and soil contamination (e.g. Barabás et al. 2001). The initial data review and subsequent sampling design will be guided by spatial statistics, in tandem with other knowledge of the system including hydrodynamics, sediment transport, river morphology, historical dredging activities, and historical sourcing."

More information on the precise use of "spatial statistics" and, specifically, how they will be used in the Saginaw River and Saginaw Bay for the MDEQ to evaluate their suitability to "guide" any activity. This is why a review and approval of work plans is required. If Dow proposes to conduct geospatial modeling as part of the work proposed in the SOWs, the following information must be directly included in the work plans for review and approval:

- The statistical basis for the sampling grid (the point to area spatial representation) and a clear basis for proposing the sample population(s) for the study areas. Dow needs to show how the proposed grid intervals are appropriate for their intended purposes. Any references and calculations must be provided in the proposal.

- The processes and equations upon which the model is built. A report documenting the development and application of the model must be presented for review. The proposal should identify what type and amount of data are to be used in developing and calibrating the model and the plan for using results of all pertinent model simulations. This information must be included in text, table, and/or figure format.

- The process by which the model will be calibrated to the "n" samples. Model calibration consists of changing values of model input parameters, within a reasonable range, in an attempt to match observed concentrations. Calibration simulations are needed to narrow the range of variability in model input data since there may be numerous choices of model input data values that may result in similar model solutions. At a minimum, model calibration must include comparisons between model-simulated conditions and field conditions for the "n" samples.

- This explanation would also account for the iterative process between data gathering and modeling. Any predictive aspects of the model must then be evaluated to determine whether it can accurately estimate the concentrations in areas where there is no data. Dow must evaluate the accuracy of the modeled results by testing of the predictive capabilities and accuracy of the model by

selecting locations to collect new samples and by comparing the modeled results to the actual concentrations in the soil samples. The MDEQ and U.S. EPA would collect audit samples as well to verify the results of the model.

36. **Section 4, Schedule and Deliverables**
The schedule must be modified to include an MDEQ and Trustee review and approval process for the Work Plans.

The schedule must be modified to include the submission of the Current Conditions Report in advance of, or with, the Phase 1 Work Plan.

37. **Section 5, References**
Environment Canada's 2002 work in the Saginaw Bay and the MDEQ's *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria, 2002,* statistical guidance should be reviewed and included in the list of references.